This finally buried the government's illusion that general practitioners should pay for information technology for the NHS, a concept about as logical as making nurses pay for patients' dressings. Renamed Project Connect, this plan offers a level playing field for general practice and primary care information technology, without which an electronic NHS will be impossible. It is a cruel twist of fate for the UK Department of Health that the Treasury has delayed implementation on the grounds of the business case not being proved, thus showing that it is not only clinicians who suffer quixotic decisions in health care.

The next link is that in September the department announced at an informatics conference that it is to legitimise electronic record keeping by general practitioners. Although this move threatens to produce "paperless" practices rather than practices with competent electronic patient records, it will stimulate the profession to demand the ability to transfer records from one general practice to another.

Even if transfer had been possible before, then the absence of a working clinical coding scheme to bring the record to life has been a major hindrance to the wish to connect up. The news that the SNOMED CT clinical coding scheme is running to time with no major problems is immensely encouraging.

When transfer occurs, it can occur over an NHSnet which is now restructuring to use the dominant internet standards and which is truly capable of moving traffic in from and out to the internet. This is in line with the needs of clinicians after long, and eventually constructive, dialogue with the NHS Executive.

And when clinical information is transferred, to be of use to patients and doctors, it needs guaranteed integrity and privacy. The recent procurement of (scalable) cryptography for pathology test result messaging, and the forthcoming strategy for cryptography, means that secure transmission of patients' data will be possible within the NHS sooner than expected.

When this kind of information moves around, it must be about the right person and delivered to the right place. For that, it requires the National Strategic Tracing Service to guarantee identity, and NHS Directory services for addresses. Both these are moving ahead on a timetable to match the preceding developments, and in line with the wishes of clinicians.

Finally, to control its immense versatility, electronic information must have standards or else it will generate garbage. The formation of standards boards, driven by clinicians, for clinical, technical, and management information are all encouraging moves underpinning the quality of the change from paper to electronics.

The critical risk now is the level of commitment from government. The electronic record is financially a speculative venture, not a profit and loss entity, but its arrival is inevitable. Securing and supporting this development work is what clinicians now need. The government must make the commitment to provide resources for this, or the NHS faces another lost decade.

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Cancer and insulin-like growth factor-I

A potential mechanism linking the environment with cancer risk

Insulin-like growth factor-I acts as an important mediator between growth hormone and growth throughout fetal and childhood development. Its effects and those of the other insulin-like growth factors are modulated by at least six different binding proteins. The role of insulin-like growth factor-I in promoting cancer has been investigated for many years, but recently the quality and quantity of evidence has increased.[1] In particular, a number of prospective studies using stored blood collected up to 14 years before the onset of disease have shown associations between insulin-like growth factor-I and prostate cancer, premenopausal breast cancer, and colon cancer.[2–4]

The risk of cancer is higher among people with raised concentrations of insulin-like growth factor-I, and it is lower among those with high concentrations of insulin-like growth factor binding protein-3 (the main binding protein). The associations are similar when people whose blood samples were taken soon before diagnosis are excluded from analyses, suggesting that the observed relations are not due to the release of the growth factor by preclinical cancers.[2–4] The effects are sizeable and stronger than the effects seen in relation to most previously reported risk factors.[1] Weaker evidence from case-control studies suggests that the ratio of insulin-like growth factor-I to insulin-like growth factor binding protein-3 may also be related to the risk of childhood leukaemia and lung cancer.[5 6]

The increasing direct epidemiological evidence that relates insulin-like growth factor-I to the risk of cancer is consistent with more circumstantial evidence. Acromegaly, in which high concentrations of growth hormone stimulate production of high concentrations of insulin-like growth factor-I, has been associated with an increased risk of colorectal cancer and breast cancer in some studies and less consistently with prostate, thyroid, and haematological malignancies.[7] In many studies anthropometric markers of the activity of insulin-like growth factor-I, such as height and leg length, are associated with cancer incidence, particularly with the cancers for which risk increases with rising concentrations of insulin-like growth factor-I.[8] While adult height is not strongly associated with concentrations of insulin-like growth factor-I in cross sectional studies, it may be a marker for this growth factor during childhood growth,[9] and this may be the period

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during which it acts to increase the risk of cancer occurring in later life.[3] Additionally, animal studies have shown that high overall intake of energy in early postnatal life is associated with an increased cancer risk, and this association has recently been found in humans.[10] In animals, calorie restriction reduces the risk of cancer primarily by reducing the circulating concentrations of insulin-like growth factor-I.[11]

Support for the link between cancer and this growth factor comes from an understanding of the potential mechanisms. Concentrations of insulin-like growth factor-I could be a surrogate for the activity of sex steroid hormones, which in turn influence the risk of cancer. However, associations between insulin-like growth factor-I and cancers dependent on sex hormones are stronger than those between directly measured concentrations of sex hormones and these cancers. Insulin-like growth factor-I may increase cell turnover and the susceptibility of cells to malignant transformation both directly and by modulating the effects of sex steroids. The fact that the risk associated with increased concentrations of insulin-like growth factor-I is greater in people whose DNA is more susceptible to damage induced by mutagens supports this suggestion.[6] Alternatively, insulin-like growth factor-I might increase the risk of cancer through its anti-apoptotic activity.[1] In this case it prevents the programmed death of cells that have been transformed thus interrupting an important process which retards the development of cancer. Experiments using animal and cell cultures have shown that the anti-apoptotic activity of insulin-like growth factor-I is counterbalanced by the activity of insulin-like growth factor binding protein-3, which may have a direct and independent stimulatory action on apoptosis.

Given the increasing evidence of the risk of cancer, caution should be exercised in the exogenous use of either insulin-like growth factor-I or substances that increase concentrations of it. Despite supposedly being restricted to use only in licensed applications, growth hormone is easily available as an anti-ageing treatment and is surprisingly widely used by athletes and body builders, who also use insulin-like growth factor-I. Those who use these products are unlikely to be aware of their potentially harmful effects.

The final accounting on the balance sheet of growth hormone, insulin-like growth factor-I, and chronic disease is uncertain. The increasing evidence of a risk of cancer may be counterbalanced by a protective effect on the risk of cardiovascular disease. Growth hormone deficiency is associated with an adverse cardiovascular risk profile and increased risk of mortality from cardiovascular disease.[12] Low concentrations of insulin-like growth factor-I are also associated with cardiovascular morbidity in the elderly.[13] Furthermore, the same studies that have shown a positive association between height and cancer risk suggest that greater height is associated with decreases in cardiovascular and all cause mortality.[14]

The predictive value of insulin-like growth factor-I may be useful in screening for cancer. For example, the ratio of insulin-like growth factor-I to prostate specific antigen may be a better predictor of the development of prostate cancer than the antigen alone.[15] Growth hormone antagonists are being investigated as treatments for some cancers and chemotherapeutic agents are being developed to block the activity of insulin-like growth factor-I or to promote the activity of insulin-like growth factor binding protein-3; these agents may offer additional ways of stimulating apoptosis in malignantly transformed cells. Lastly, better knowledge of the factors that influence overall concentrations of insulin-like growth factor-I may help in devising strategies to prevent cancer at a population level.

Much recent attention has focused on the human genome project and its potential for unravelling the causes of cancer. The genes that have been identified as causing cancer so far account for only a small proportion of major cancers. The rapid and sizeable changes in the incidence of cancer that have been seen during times of economic development coupled with the findings from twin studies—which compare the concordance of cancer risk in identical and non-identical twins to determine the relative influence of genetic and environmental factors—both point to the importance of non-genomic factors.[16] The new epidemiological findings about insulin-like growth factor-I provide one potential mechanism through which an array of previously identified environmental risk factors may act.

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